

WHAT IS CLAIMED IS:

- 1 1. A method of propagating changes made to a design model having one or more elements,
2 comprising:
3 identifying a change to a first element;
4 creating a first step based on the structure of the first element or on a relationship
5 between the first element and another element or elements;
6 creating a second step based on the first step and the structure of one of the elements
7 or on a relationship between two of the elements; and
8 executing the steps to change at one or more elements to produce a model that
9 accurately reflects the change to the first element.
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11 2. The method of claim 1, wherein the element is a model component of a computer-aided
12 design model.
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14 3. The method of claim 2, wherein the computer-aided design model is a model of an
15 architectural structure.
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17 4. The method of claim 1, further comprising sorting at least some of the steps and the
18 before executing the steps.
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20 5. The method of claim 4, wherein the sorting is conducted using a depth-first search sorting
21 method.
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23 6. The method of claim 1, wherein the steps are stored in a step repository.
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25 7. The method of claim 1, wherein one of the steps is a nul step.
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27 8. The method of claim 7, wherein the nul step instigates regeneration.
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- 29 9. The method of step 1, further comprising providing an atom associated with the first
30 element, the atom marking changes made to the first element and expressing a
31 dependency between one or more steps.
- 32
- 33 10. The method of step 1, wherein the second step depends on a relationship between the first
34 element and a class of elements.
- 35
- 36 11. The method of claim 1, further comprising executing geometry steps associated with the
37 first step or the second step.
- 38
- 39 12. The method of claim 1, further comprising identifying a locked step and limiting the
40 execution of the locked step.
- 41
- 42 13. The method of claim 1, further comprising generating an error signal if the first step or
43 the second step cannot be sorted.
- 44
- 45 14. A system for regenerating a design model, comprising:
46 a model element;
47 a step propagator that receives a first step that represents changes in the model
48 element, and produces a second step that represents other changes in the model
49 element that are dependent on the first step; and
50 a step executor that executes the first step and the second step
- 51
- 52 15. The system of claim 14, further comprising a step sorter that sorts the first step and the
53 second step according to dependencies between the steps.
- 54
- 55 16. The system of claim 14, further comprising an element table that stores the model
56 element.
- 57
- 58 17. The system of claim 14, further comprising an atom associated with the model element,
59 the atom linking the model element to the first step.

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61 18. A method of propagating changes through a plurality of elements in a model, comprising:
62 analyzing changes in a first element;
63 generating a first step to carry out at least some of the changes in the first element;
64 generating a second step based on a predefined relationship between the first element
65 and one or more other elements, or on changes in a predefined relationship
66 between the first element and one or more other elements;
67 executing the first step and the second step on the plurality of elements to reflect the
68 changes in the first element and the relationship between the first element and the
69 one or more elements.

70
71 19. The method of claim 18, wherein the plurality of elements are elements in a computer-
72 aided design model.

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74 20. The method of claim 18, wherein the second step is one of a plurality of steps that can
75 effect changes to the same element, and the second step is selected from the plurality of
76 steps based on the first step.

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78 21. The method of claim 20, wherein the second step is selected from the plurality of steps
79 based on the generation of other steps.

80
81 22. The method of claim 18, further comprising sorting the first step and the plurality of steps
82 to ensure that each step is executed after steps on which it depends are executed.

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84 23. The method of claim 18, wherein one of the steps is a nul step whose execution does not
85 affect the model.

86
87 24. The method of claim 18, wherein locked steps are not executed.

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89 25. The method of claim 18, wherein the plurality of steps is generated by prediction.
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91 26. The method of claim 18, wherein the plurality of steps is selected from among a group of
92 possible pluralities of steps.

93
94 27. The method of claim 18, wherein all of the steps on one element are executed before any
95 steps on the next element.

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97 28. The method of claim 18, wherein the first plurality of steps depends on the execution of
98 the first step.

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100 29. The method of claim 18, further comprising verifying the elements after execution for
101 constraint satisfaction.

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103 30. A method for updating data for a computer model for graphical display, comprising:
104 analyzing an element in the computer model to determine whether the element has
105 been touched by a change in the model;
106 associating the elements with one or more steps that effect the change to the model;
107 creating one or more additional steps that propagate changes to the computer model
108 based on relationships between the element and other elements in the computer
109 model;
110 sorting the one or more steps and the one or more additional steps to eliminate
111 interferences among the steps;
112 executing the sorted steps.

113
114 31. A method of propagating changes made in one data element to a related data element,
115 comprising:
116 accumulating changes made in the one data element;
117 identifying a predetermined number of possible mutually-exclusive sets of changes
118 that may be made in the related data element;
119 selecting the most appropriate set of changes by employing a predetermined selection
120 standard;

121 testing the selected set of changes to determine whether it is an appropriate set of
122 changes.

123

124 32. A method of propagating a change made to an element in a computer-aided design
125 model, comprising:

126 identifying an atom associated with the element;

127 generating a first step to carry out the change;

128 retrieving relationship information that defines predetermined relationships among
129 elements in the model;

130 generating propagated steps that depend on the change and the relationship
131 information;

132 sorting the steps; and

133 executing the steps to properly reflect the change to the element and to related
134 elements.

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